consumer goods to meet the needs of the consumer; no one has yet designed an auto or a refrigerator that would be efficient to scrap and from which the metal and other production materials could easily be salvaged.

Our food processing industries have concentrated on getting food and drink to the consumer in an unpolluted, hygienic, and attractive condition; but little concern has been directed to the ultimate disposal of the containers in which that food and drink was packaged. We need a faster rotting beer can, for instance, which will at the same time preserve the beer adequately until it is consumed.

It seems clear to me that Americans in the future must learn a great deal more about production, consumption, and residual management processes than we have generally known in the past. We will be, I think, forced increasingly to choose among or between essentially incompatible desires and demands. Costs will have to be incurred to dispose of wastes in acceptable ways; one cannot have both the lowest cost electricity or other goods or services and also the purest air and cleanest streams.

If we choose a degree of improved resource quality, then we must restrain those productive mechanisms which would produce cheaper products at the expense of more pollution, or we must provide new incentives for producers to reduce pollution as well as to produce more cheaply. The competitive business system has put great rewards on efficiency in production, but few or no rewards to minimizing pollution. Government action has increasingly intervened, to provide new controls or new incentives. I see no reason to expect that public action will not be necessary in the future.

We can do a great many things to preserve or create a world we want, but we cannot have everything—some situations or outputs are mutually incompatible. What do we, as a people, really want?

THE YEARS AHEAD IN AGRICULTURE

FARMING OPERATIONS will be increasingly coordinated with related industries into a broad and dynamic food and fiber industry. By 1980–85 farms may number at least a third fewer than today. And a larger share of them will be the more specialized and highly commercialized operations.

These projections reflect prospects for continued advances in technology, rising costs for labor and land, demand growth, and extensive demand shifts among commodities. They also reflect the prospects that farming will become more factory-like and coordinated in a complex of related agribusinesses.

Today's food and fiber industry is made up of a group of closely related industries. They produce and move to the final users, mostly consumer households, a volume of food and fiber products valued at nearly a fifth of the total value of goods and services produced (Gross National Product) by the economy.

Expected growth in economic activity and population provide a basis for appraising demands on farming and the agricultural industry. Although economic growth will continue small in 1970, growth potential is favorable for the decade, in view of prospects for a rapid increase in the labor force and continued advances in production technology.

Population of the United States totaled more than 205 million in 1970. The projected rise to about 230 million people by 1980 probably will not quite match the 14 percent increase in the 1960's.

During the seventies the most vital and fertile 25-to-34-year age group will increase by 50 percent. The number

of people 45 to 54 years old will decline.

This changing age mix will result in rapid growth in the labor force among the younger and most vigorous workers. They will be establishing new families and demanding all manner of goods and services. Marriage rates will increase, and the number of children under 5 years may rise by 30 to 40 percent in the decade.

Combining the major elements of growth—labor force, hours worked, and productivity—suggests an economic growth potential of more than 4 percent per year in the 1970's. This would increase the output of goods and services by around 50 percent in the decade.

With a much less inflationary rise in the general price level, the Gross National Product may increase at an average annual rate in excess of 6 percent. This would add up to a rise of 85 percent in the decade, or to around $1.8 trillion by 1980 compared with the $980 billion estimated for 1970. Such economic growth would materially expand domestic markets for the agricultural industry.

Consumption of food and fiber products as they come from the farm changes little in response to changes in income and prices. Per capita use may increase only 1 to 2 percent with a 10 percent advance in income or a 10 percent reduction in prices.

The small increase in per capita use during recent years is due mainly to upgrading the diet to higher valued meats and convenience foods. Consumption of foods in pounds and calories has trended downward. However, today's housewife desires quality, variety, and convenience in her foods, textiles, and clothing. Accordingly, her demand is strong for related processing and services.

Consumer demand for these services is possibly 5 times as responsive as the raw farm product to changes in prices and incomes. A 10 percent increase in income may step up the demand for processing and marketing services, including eating out, by possibly 8 percent or more.

Combined consumer expenditures for such final products as food, beverages, clothing, shoes, and tobacco, both for the farm product and related services, usually increase about two-thirds as much as consumer income. Thus, expenditures for food are a declining percentage of consumer income as the economy grows.

In 1970 consumers will spend around $190 billion for food, beverages, clothing, footwear, and tobacco. Food and beverage outlays, projected to 1980 on the basis of their relationship to income, may increase about 65 percent to more than $205 billion. Combined expenditures for clothing, tobacco, and shoes are projected to rise nearly 85 percent to around $112 billion.

Expenditures for products of the agricultural processing industries increased nearly 80 percent in the decade 1958 to 1968 compared with an increase of about 25 percent in the value of farm output. Value of the major final consumer products originating in agriculture increased about 60 percent.

In 1968, around two-thirds of the value of consumer expenditures for food represented purchases from processing industries. Small direct purchases from agriculture and outlays for trade and transportation services accounted for the balance. The value of farm products sold to the processor plus direct consumer sales by farmers equaled around a fourth of total consumer expenditures for food and beverages.

Demand for the processing and marketing services purchased with basic farm products, including eating out, will increase in coming years perhaps about as rapidly as consumer income. In response, the output of the processing and marketing industries may increase 80 to 90 percent in the 1970's.

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Domestic markets for raw farm products will likely increase only a little faster than population in the 1970's—perhaps 15 to 18 percent. Most of the increase will come in red meats and poultry and in the feed crops needed by livestock.

Export markets will remain important for grains, soybeans, fats and oils, some fruits, and perhaps for cotton and tobacco. Although growth in exports may not match the fast pace from 1950 to 1965, expected increases greatly exceed the rate of growth in the domestic market.

Domestic and export markets for food and fiber products largely determine a projected 20 percent increase in farm output. Purchased materials and goods used in production, which in recent years accounted for around two-thirds of farm output, will increase possibly half again as much as output. These purchased inputs include such farm products as livestock, feed, and seed, as well as fertilizer, chemicals and petroleum, agricultural processing, transportation, trade, and business services.

Recent industry input-output tables, which show deliveries of products to the final consumer as well as sales and purchases among some 370 other industries, suggest that an increase of $1 billion in deliveries to consumers of food from livestock products would require an increase in total economic activity of almost $2.7 billion.

Perhaps the most rapid changes in agriculture will continue to be in resource adjustment and associated changes in productivity and farm numbers.

Shifts in resource use, largely in response to advances in technology and changes in the relative cost of inputs, have resulted in the replacement of labor and, to some extent, land with machinery and equipment, fertilizer, chemicals, and other nonfarm resources. These inputs will continue to substitute for increasingly dear labor and land.

Yields will continue to increase and gains may be rapid enough in the 1970's to match demand expansion without an increase in the use of land.

The volume of resources used in agriculture has changed little in the past two decades despite big changes in the capital-labor-land mix. In view of prospects for further moderate growth in demand and continued advances in productivity, total resource use in agriculture may change little in the next 10 to 15 years.

Farms now contain more than a billion acres of land, some 450 million acres of which are classified as cropland. Around 300 million acres have been harvested in recent years. The remaining cropland has been pasture, fallow, idle, or diverted acreage under Government programs. In recent years, 50 to 60 million acres of cropland have been so diverted.

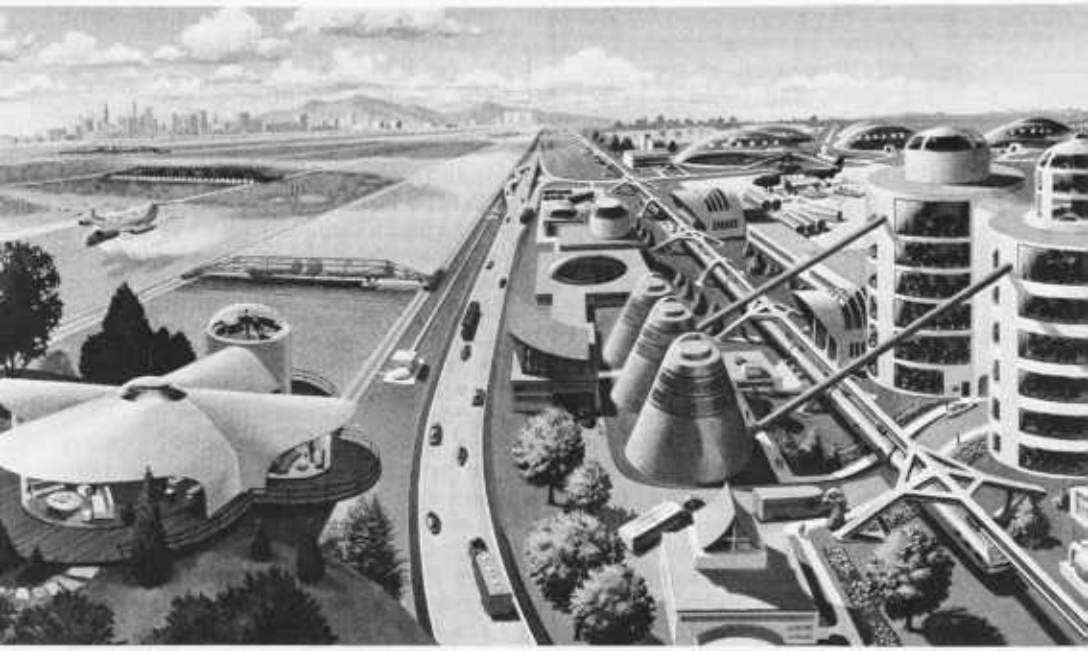
In addition to the 450 million acre cropland base, possibly 250 million acres are suitable for regular cultivation and could be brought into use if demand expansion or incentives were strong enough.

Crop yields per acre will continue to increase, possibly about as fast as in the past. The growing concern about contamination of our environment could operate to moderate chemical inputs and to slow yield advances. Moreover, as agriculture approaches an industry of large commercial units, yield advances due to structural change will be slower.

Nevertheless, crop yields probably will continue to increase about as rapidly as growth in demand for crops in the next 10 to 15 years.

The stock of productive assets in agriculture—consisting mainly of land, buildings, and livestock—increased less than 5 percent in real (adjusted for price level) terms during the past decade. Although outlays for purchased inputs will continue to increase more rapidly than output, combined use of productive assets may increase only modestly, particularly if the pace of farm consolidation continues.

The projected rapid rise in labor productivity will require increased use of capital per farmworker. But if



Advanced farm of future may have high-rise livestock feeding houses with connected feed mills, controlled environment fields, remote controlled combine-tillers, rapid transportation and control towers equipped with computers, instantaneous market and weather reports, plus analytical techniques for gearing production to markets. (Illustration © National Geographic Society)

agriculture is made up of fewer farmworkers as well as fewer and larger farms, overall capital requirements may grow relatively slowly.

Labor employed in agriculture will decline further in coming years. In 1969 farm employment was about 4.6 million, and only 1 million of these were hired workers. Total employment was about 60 percent of what it had been a decade earlier.

Projected labor requirements for 1980 suggest around 3 to 3½ million workers. And farm population, as now defined, may total around 7 to 8 million by 1980 compared with 10.3 million in 1969.

Technical possibilities exist for an accelerated combination of farms into large efficient units. Production technology and the feasibility of more interindustry coordination of operations will continue to be a major force in farm consolidation.

Projections of recent trends in farm numbers by size of operation suggest around 2 million farm units by 1980. The fewer than 3 million farms in 1969 compares with over 4 million in 1959 and 5.7 million in 1949.

The size distribution of the 2 million farms projected for 1980 would look about as follows:

- Around a fourth of the farms would have cash receipts above $20,000 per farm. They would account for 85 to 90 percent of total cash receipts, 75 percent of net farm income, 75 percent of productive assets, and possibly 60 to 70 percent of the land and labor employed in agriculture.
- Some 25 to 30 percent of the farms would fall in a group with cash receipts per farm ranging from $2,500 to $20,000. These farms may account for around a tenth of cash receipts, a fourth of the labor, and perhaps 15 to 20 percent of the land and productive assets used in agriculture.
- Possibly 40 to 45 percent of the farms would be largely rural resi-

dences. They may account for less than 2 percent of total cash receipts, around 10 percent of the land and other assets, and possibly 15 percent of total labor used. Most of their income would continue to come from off-farm sources.

Although the organization of agriculture projected above appears reasonable based on recent trends, technical possibilities exist for an even greater shift to larger commercial farm units. U.S. agriculture in 1980 could be made up of farms of the size and general organization of today's Class I commercial farms having sales above $40,000 per farm. Perhaps around 400,000 such farms could produce the farm output projected for 1980.

It is equally reasonable to assume an even greater consolidation into units much like today's large-scale farm units with sales above $100,000. These farms are increasing in number the most rapidly of all size groups. Possibly fewer than 200,000 of today's large-scale farms could produce the farm output projected for 1980.

Such farms could average gross income around $375,000 to $400,000 per farm in 1965 prices. Net income may run $70,000 to $80,000 per farm.

Farms this size, organized as today, would use productive assets of perhaps $1 million or more per farm and average around 4,000 acres per farm. Total acreage of land in farms probably would run well below the billion acres now in farms, but there might be little change in total acreage of land planted to crops.

Farms this size may average 7 or 8 men per farm, but total employment in farming could drop to 1½ to 2 million workers, including family labor.

Farm and related marketing and processing operations will become more highly coordinated for some commodities even though the farm operating unit does not become huge. There is widespread evidence that the agribusiness industry is extending its technical and managerial skill into the production and marketing of some foods. But the process is selective and so far involves mainly poultry, eggs, citrus, and a few other crops.

The mix of farm types that may evolve by 1980–85 can be only roughly indicated, partly because even specialized farms will produce more than one commodity.

However, if the farms of 1980 were organized much like today's large-scale farm, the following numbers could provide projected output for selected commodities:

- Possibly 60,000 to 70,000 livestock farms.
- Some 20,000 to 30,000 poultry farms and a similar number of dairy farms.
- Only 10,000 to 15,000 cotton farms.
- Probably no more than 5,000 tobacco farms.
- Perhaps around 100,000 large-scale grain farms.

Farming by 1980 probably will not be as much of a two-sector farm-nonfarm split as it is today. Farming operations will become more highly integrated into the food and fiber industry.

Many production and marketing processes will be even more factory-like, with output geared to consumer demand. This will involve greater coordination between producers and processors, integrated planning and management, and close orientation to market demands.

The food, beverages, tobacco, clothing, shoes, and other products of the agribusiness industries, which now amount to a third of total consumer outlays, will continue to be of primary importance to the consumer.

A more highly coordinated industry of large farms very likely would operate more like the large nonfarm manufacturing industries. Accordingly, planning of capital outlays, production schedules, and pricing of food and fiber products may be more closely tailored to market demand and to the income goals of the agricultural industry.